VISCA
VINEYARDS INTEGRATED SMART CLIMATE APPLICATION

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Working with probabilities

2nd General Meeting

10th-12th November 2017

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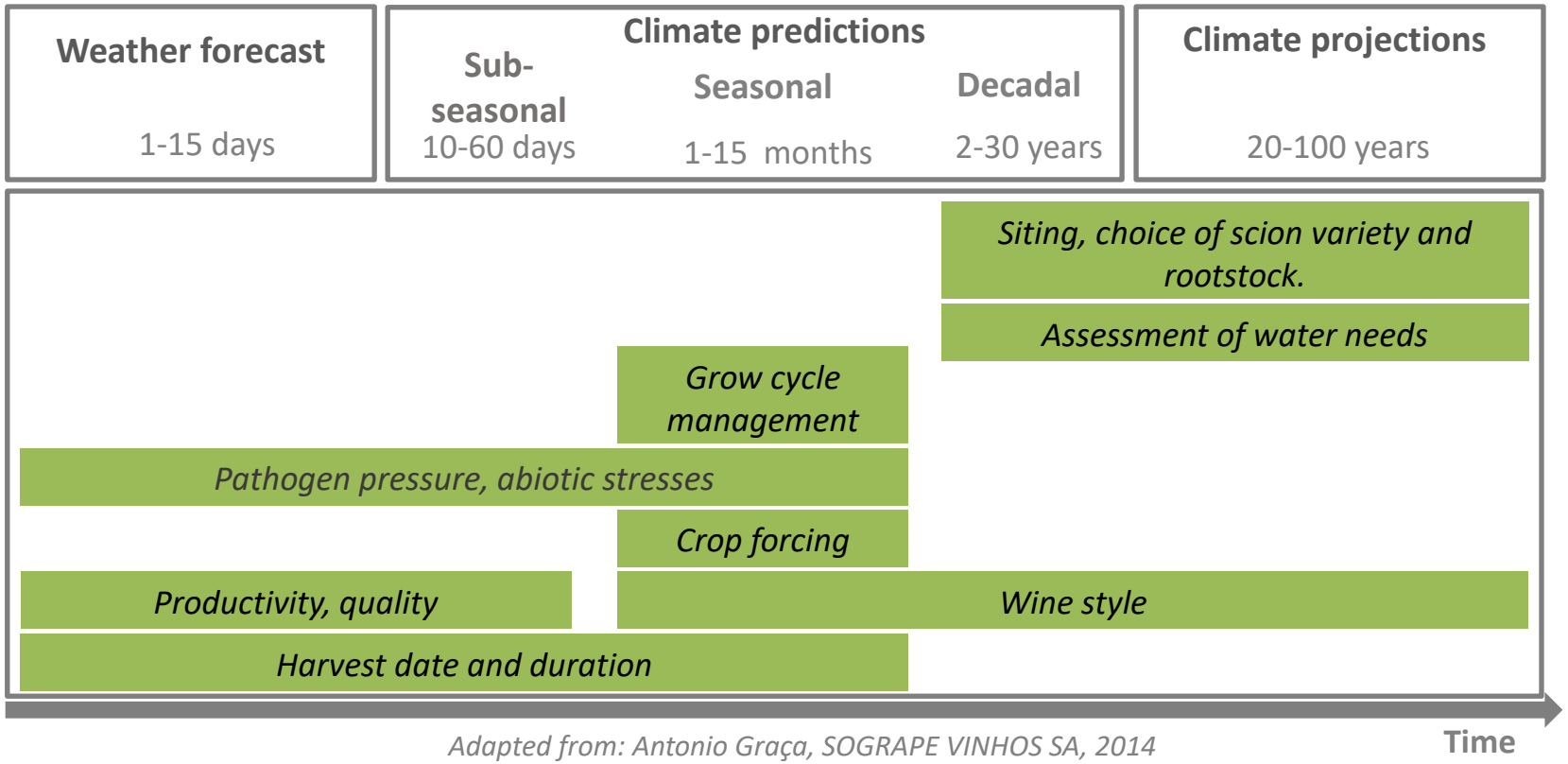
Nube González – Albert Soret
Barcelona Supercomputing Centre

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730253.

Decisions targeted by forecast type



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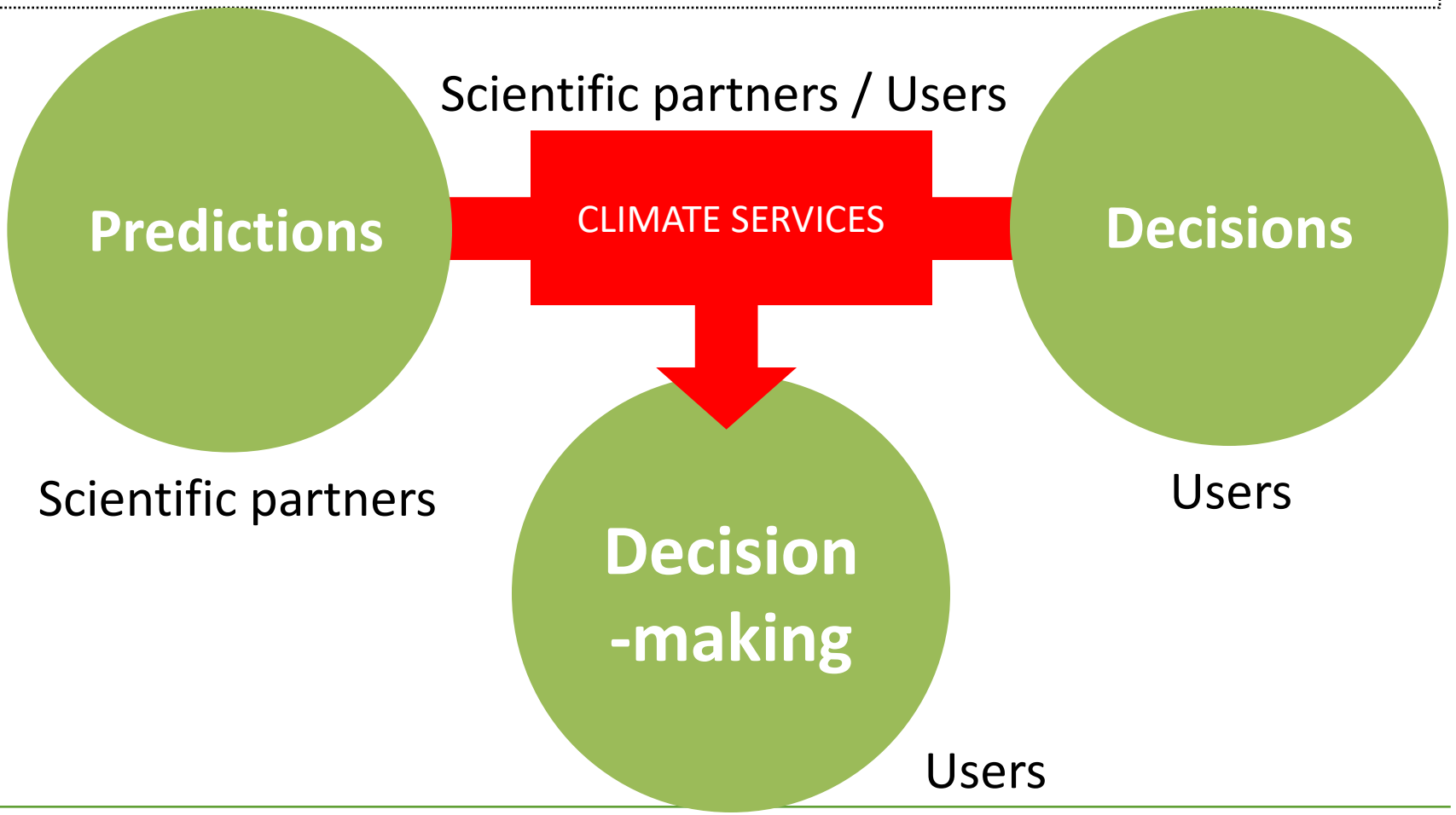
From climate data to climate services



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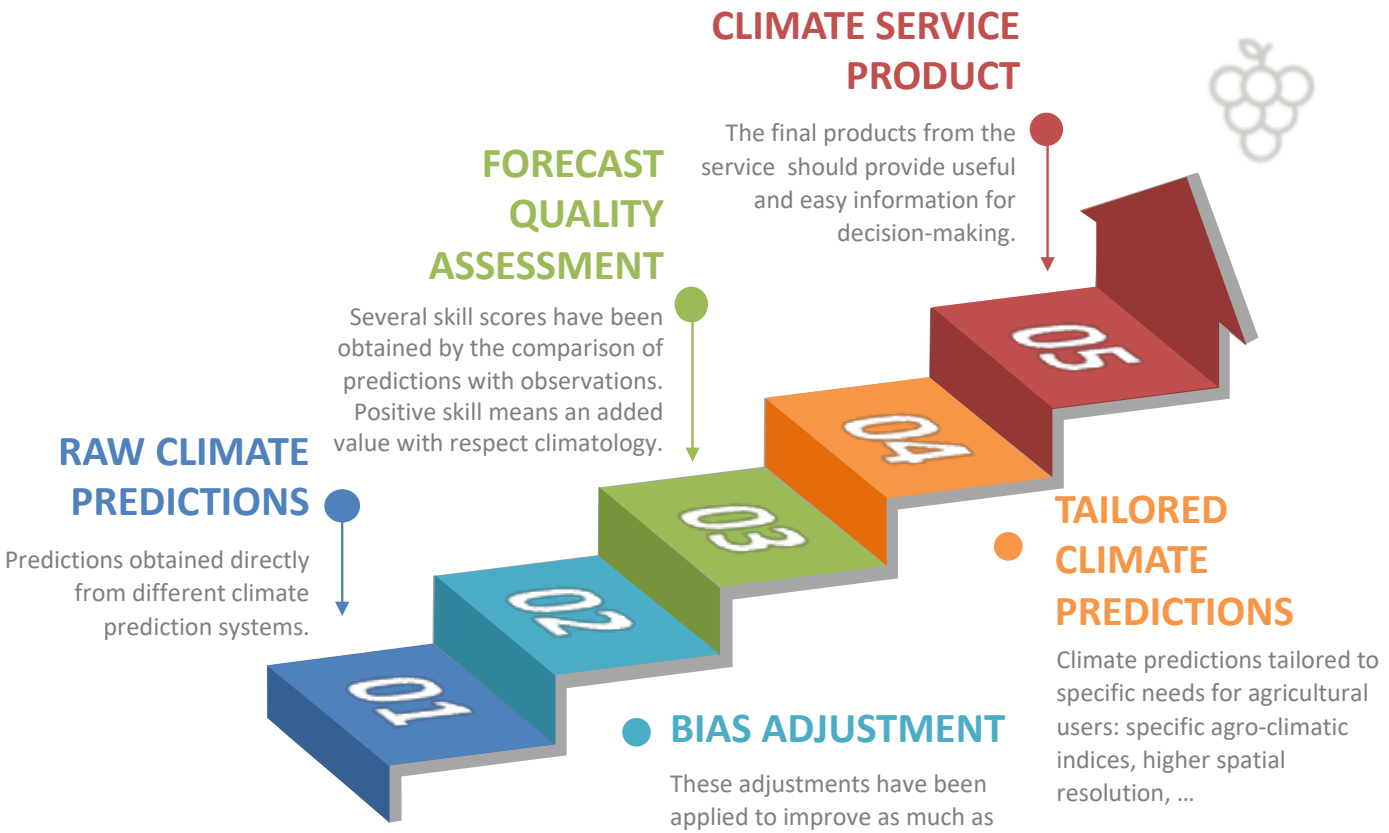

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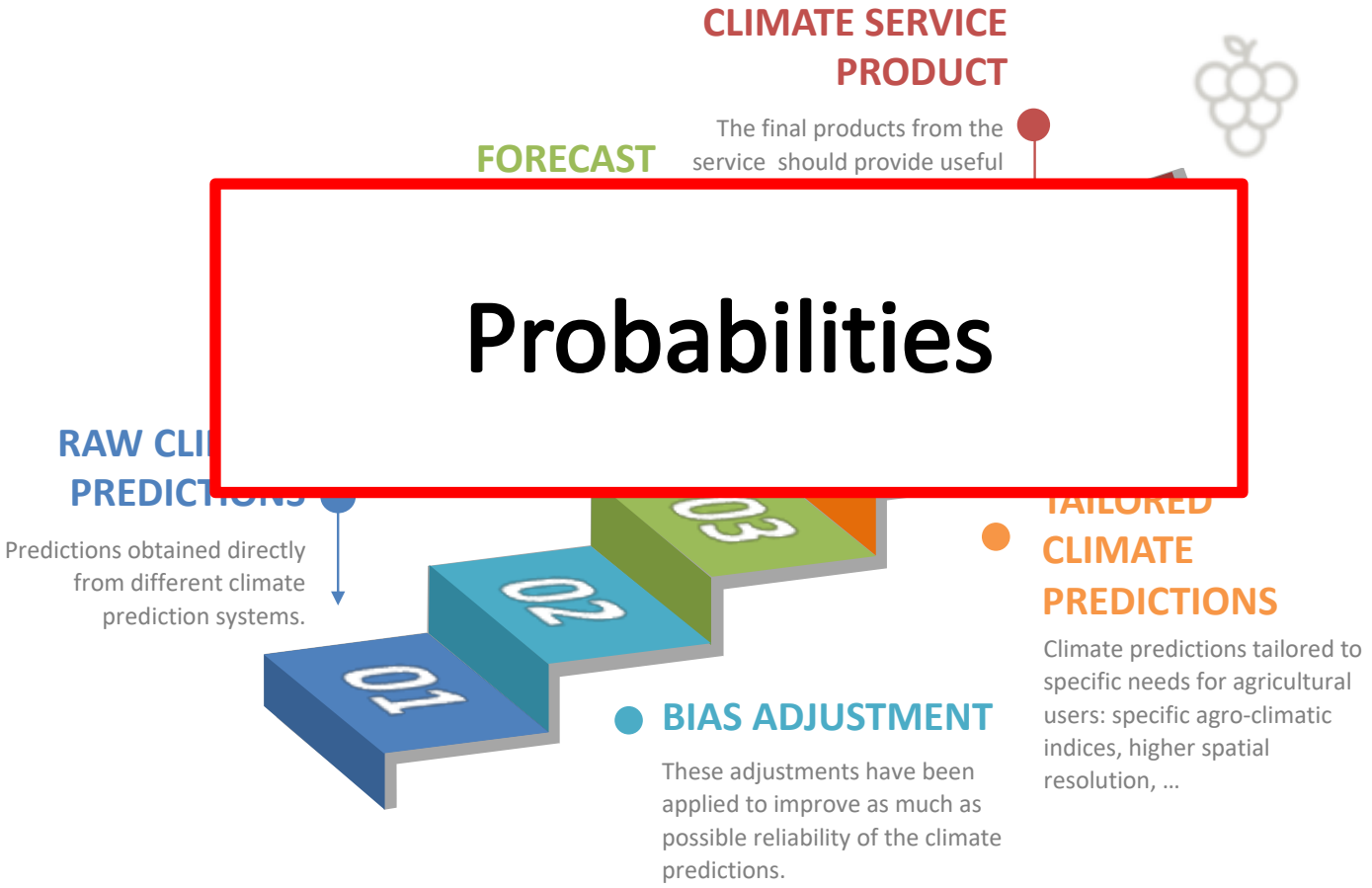

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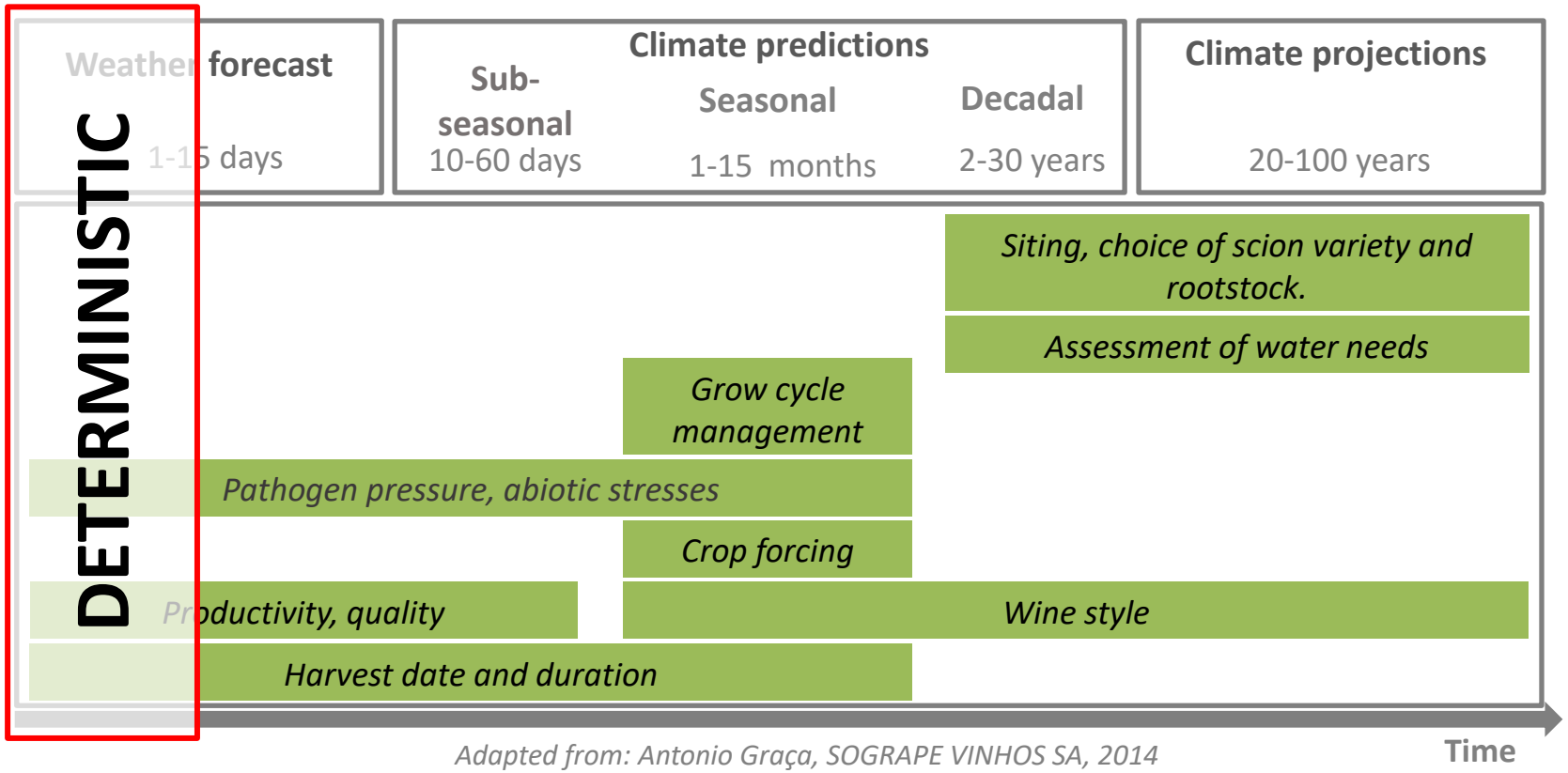

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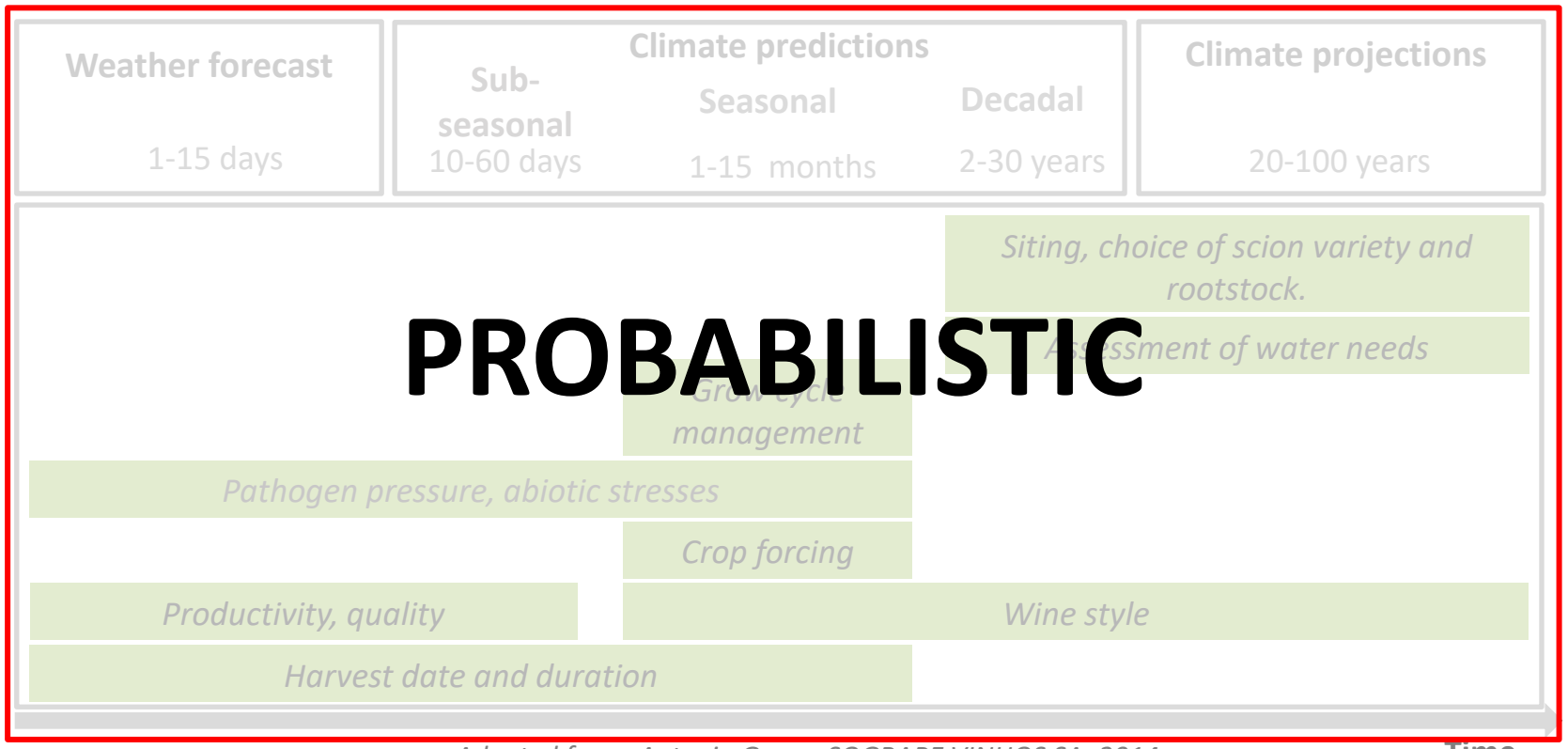

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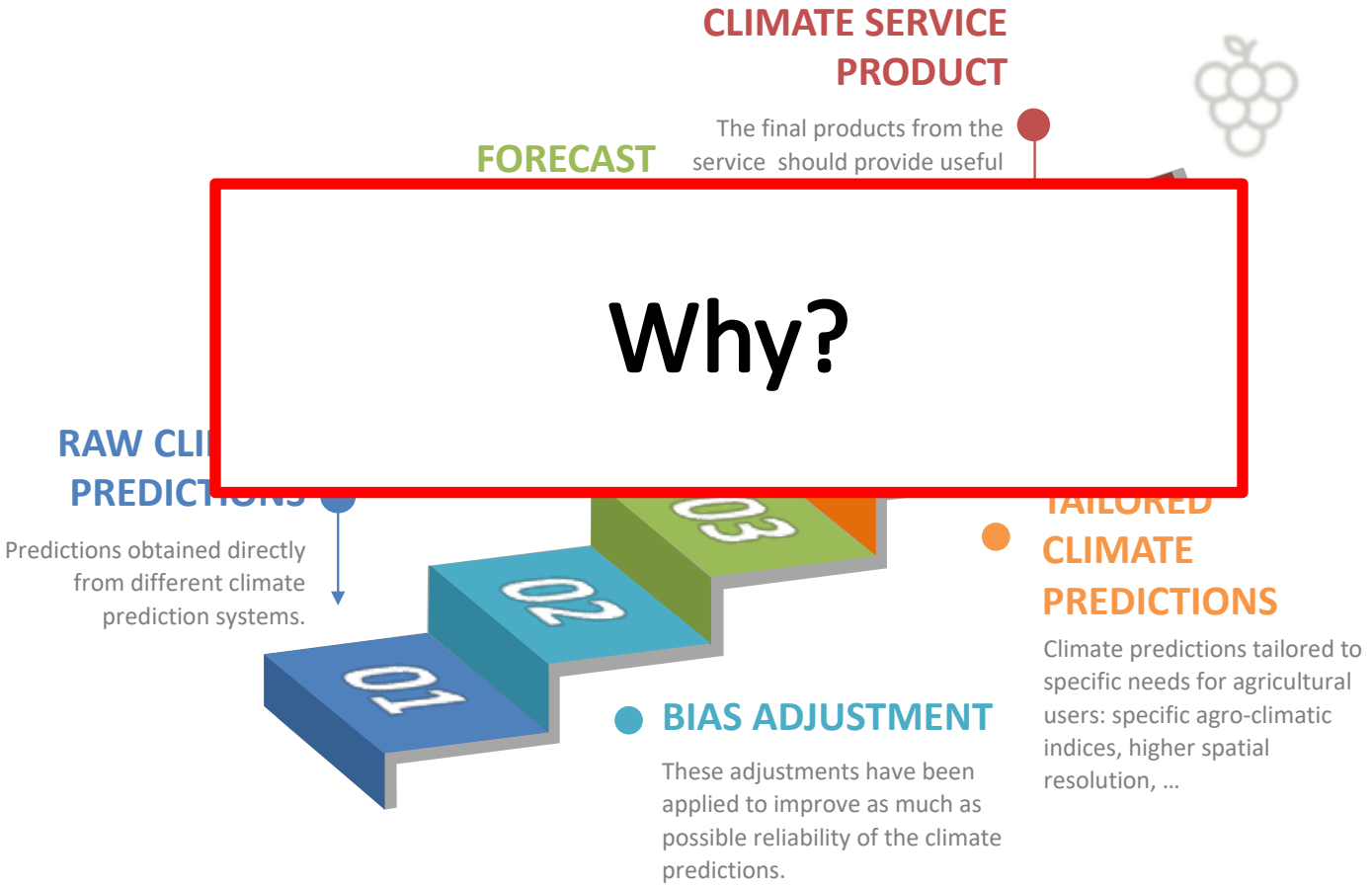

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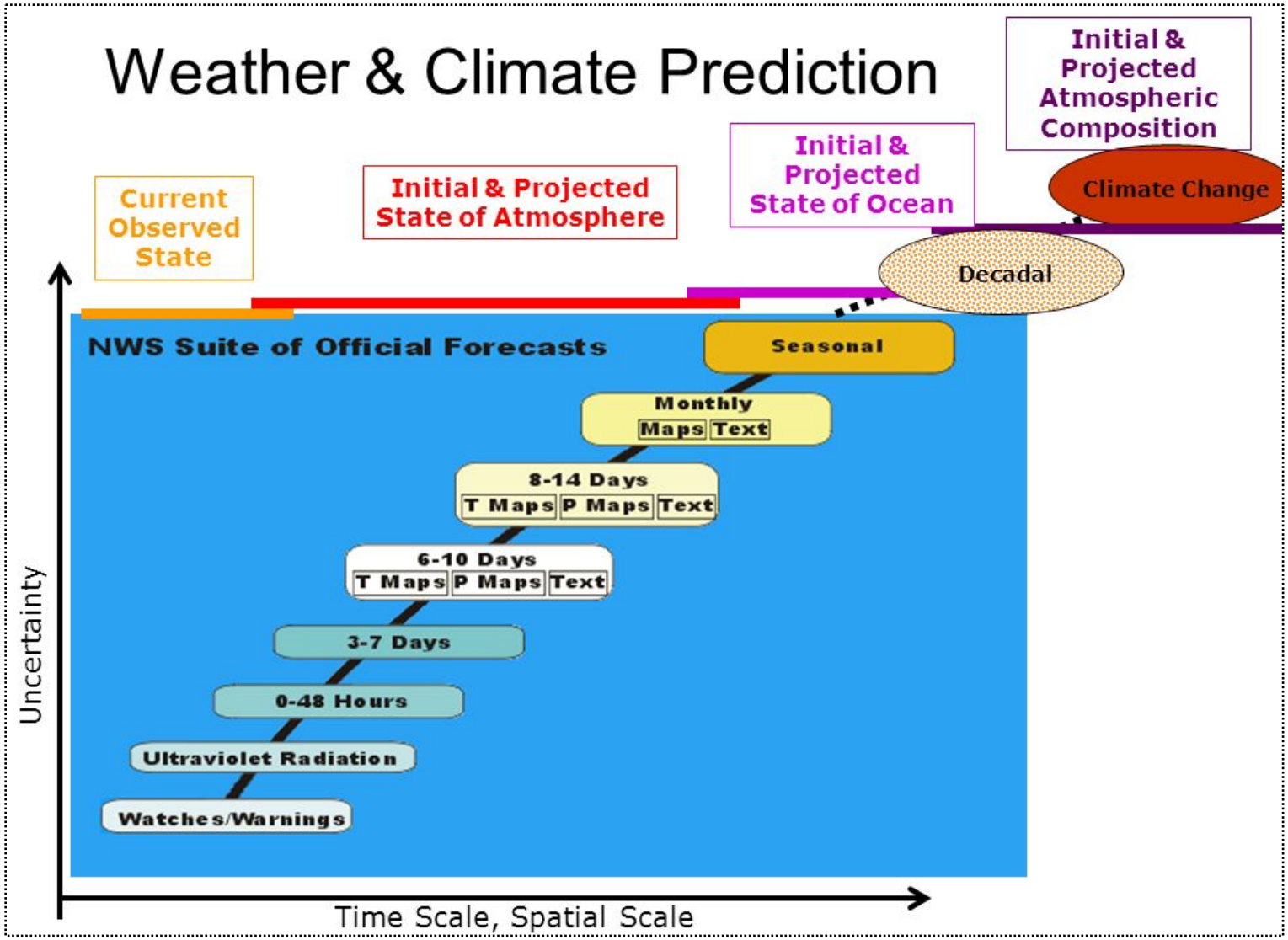

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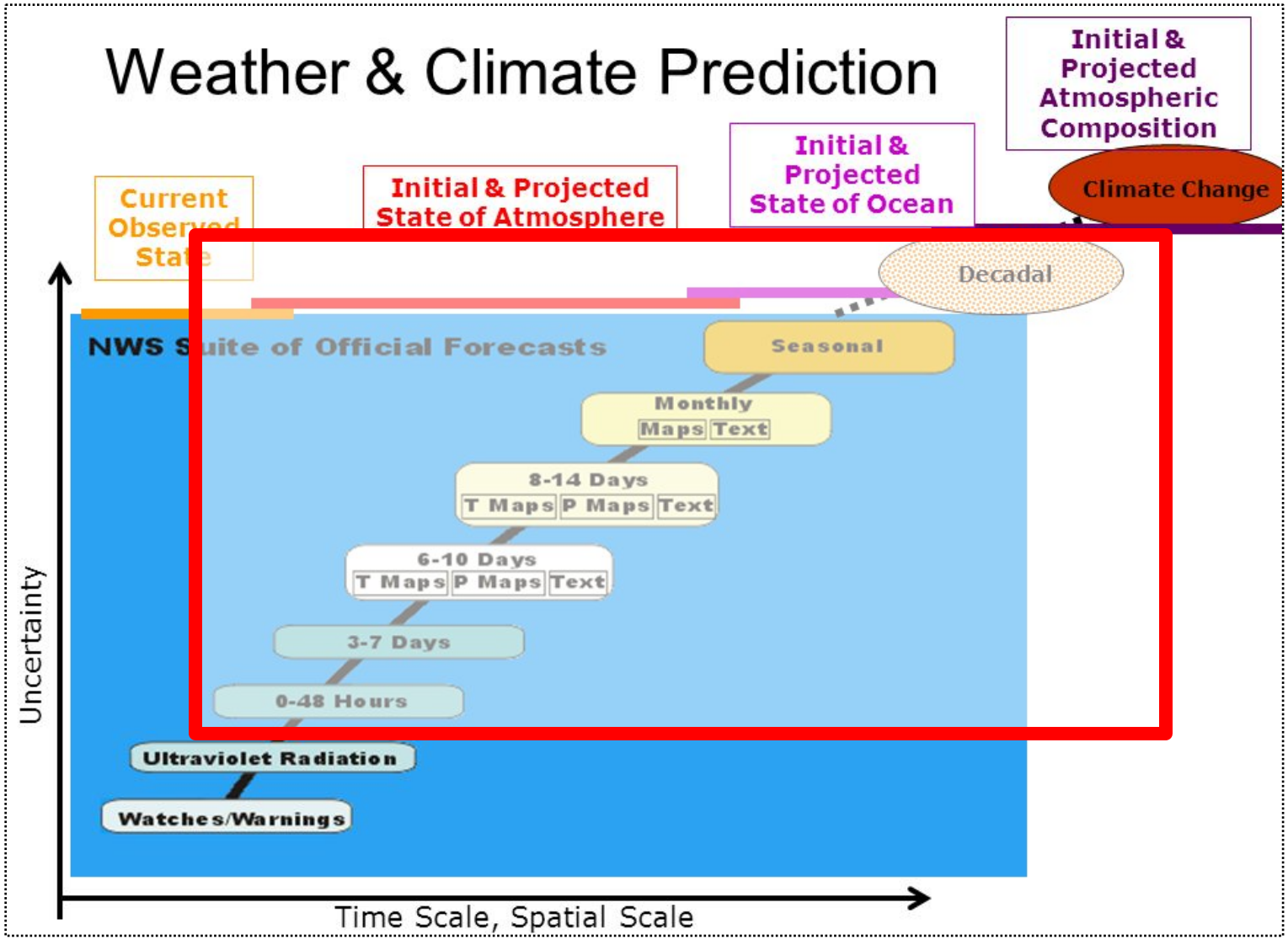

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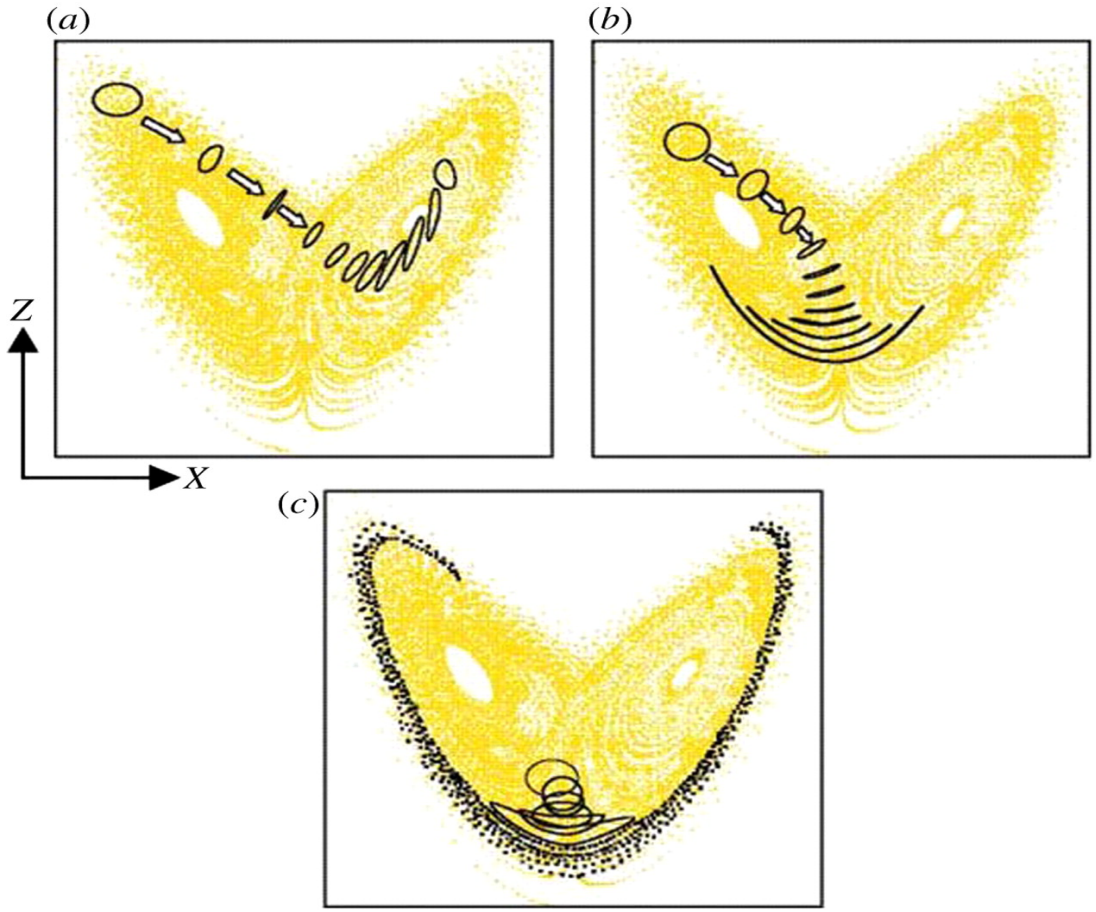
Initial conditions uncertainty



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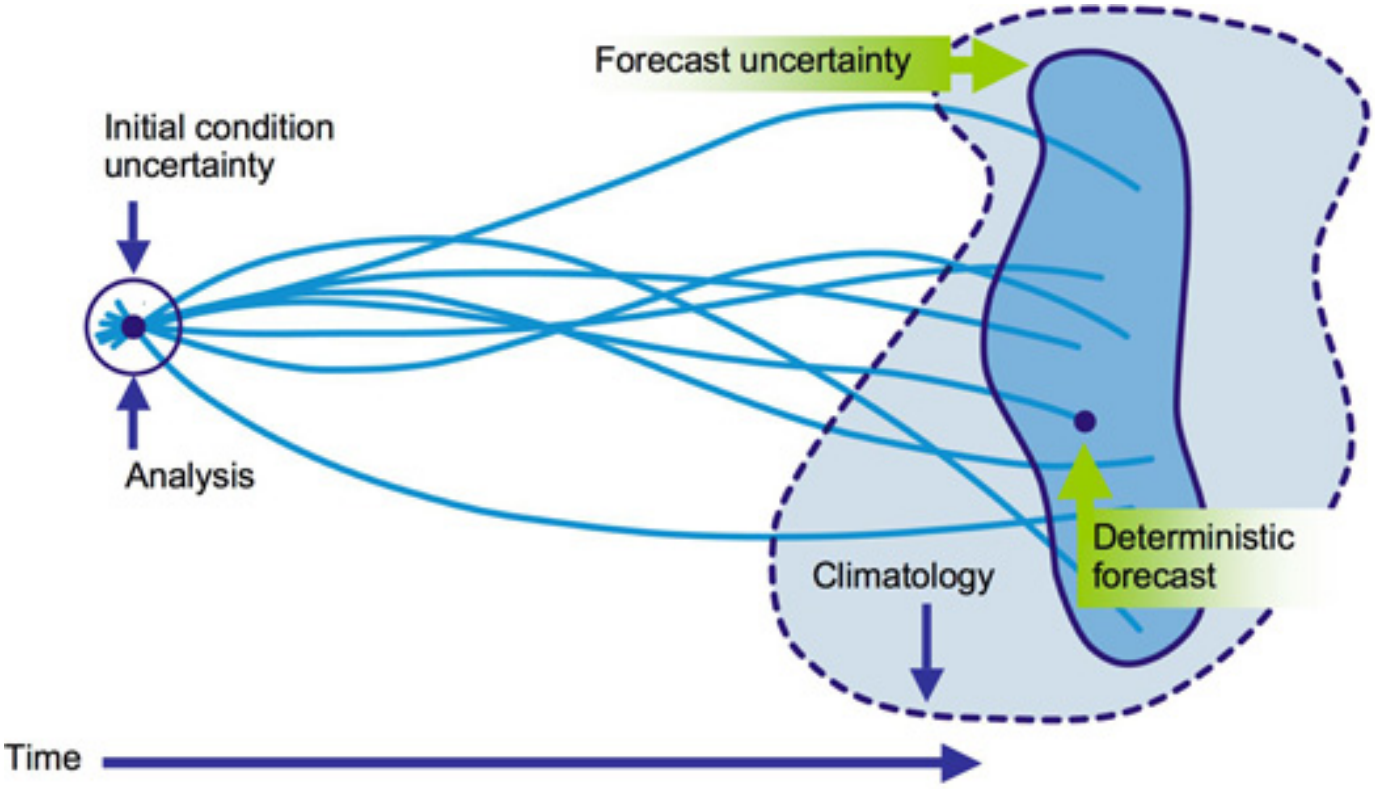
Uncertainty in predictions



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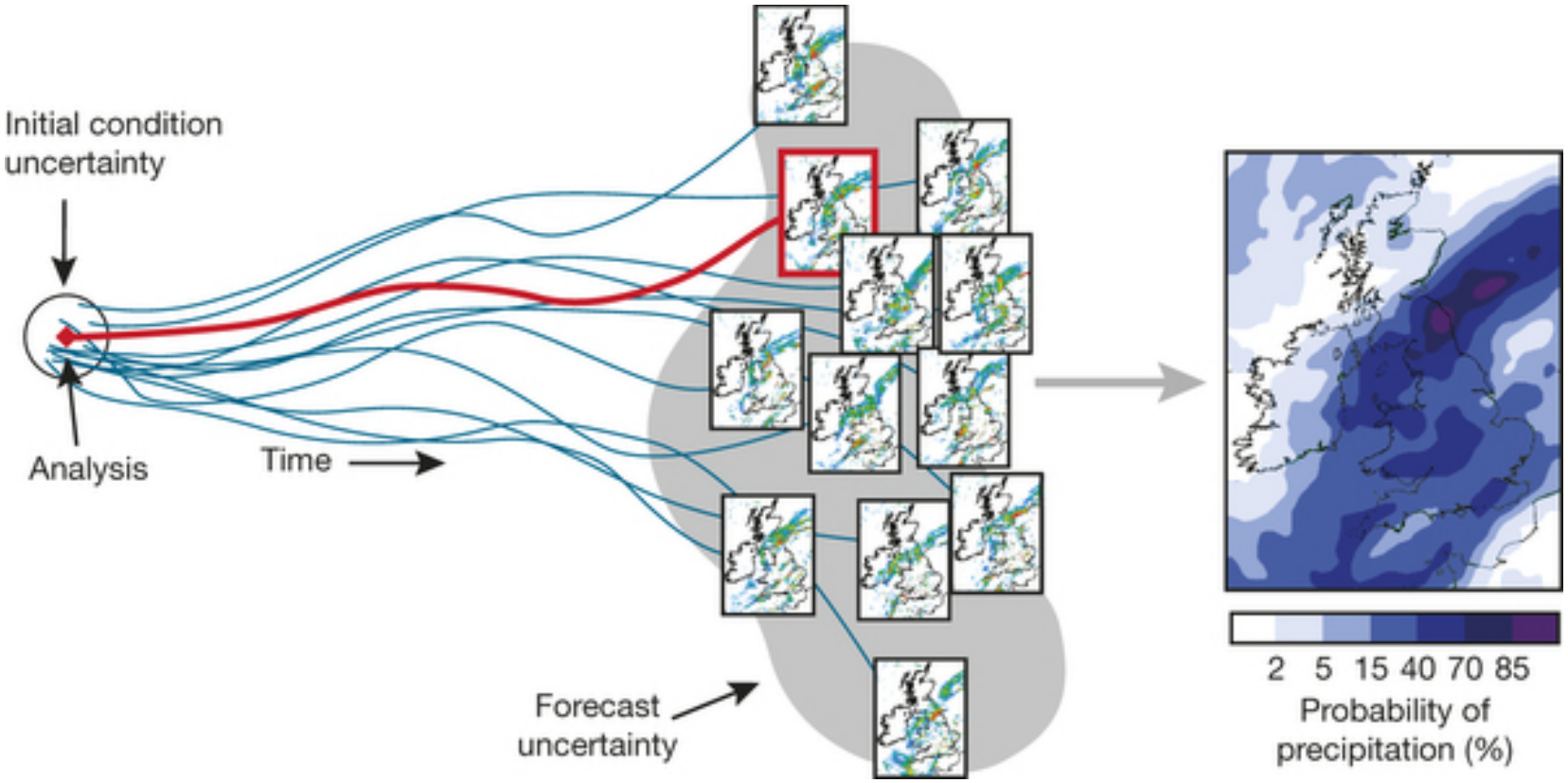

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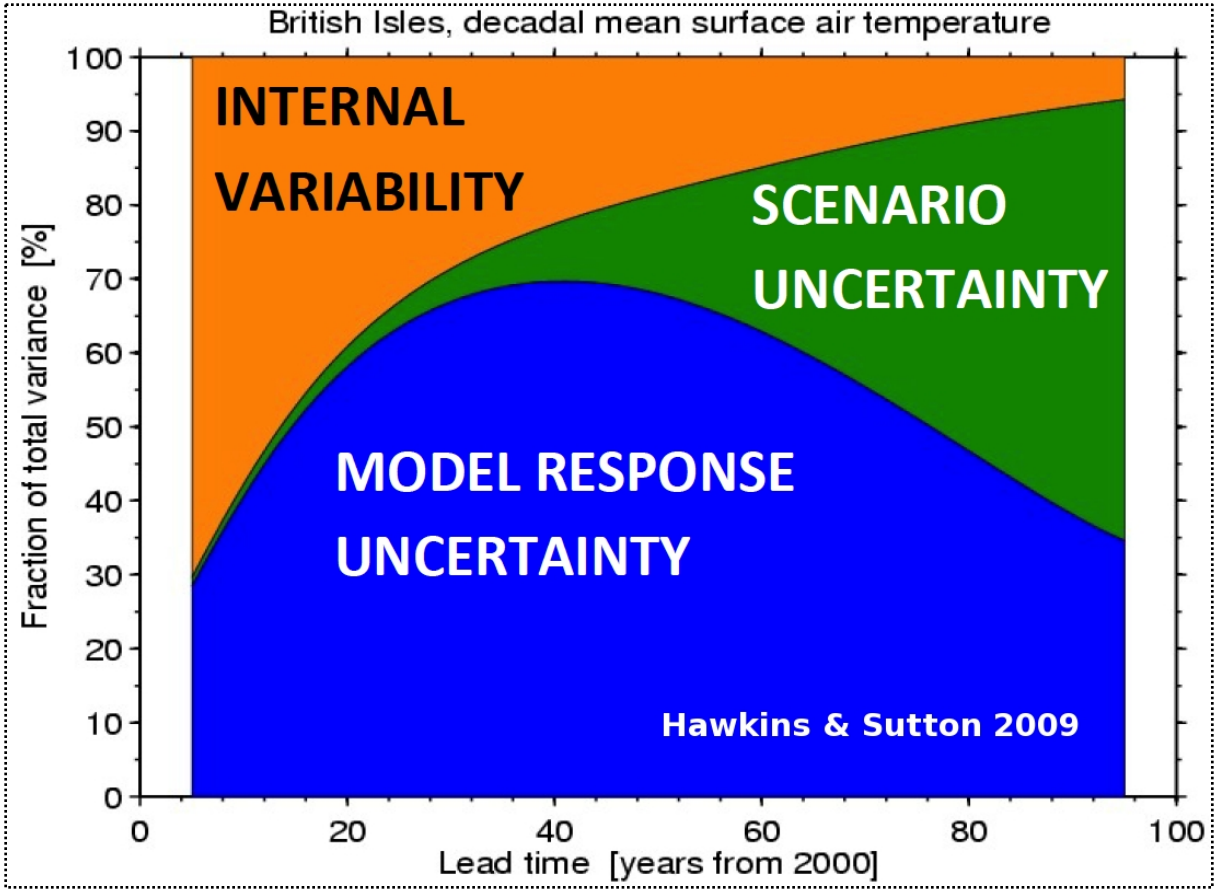
Uncertainty in projections



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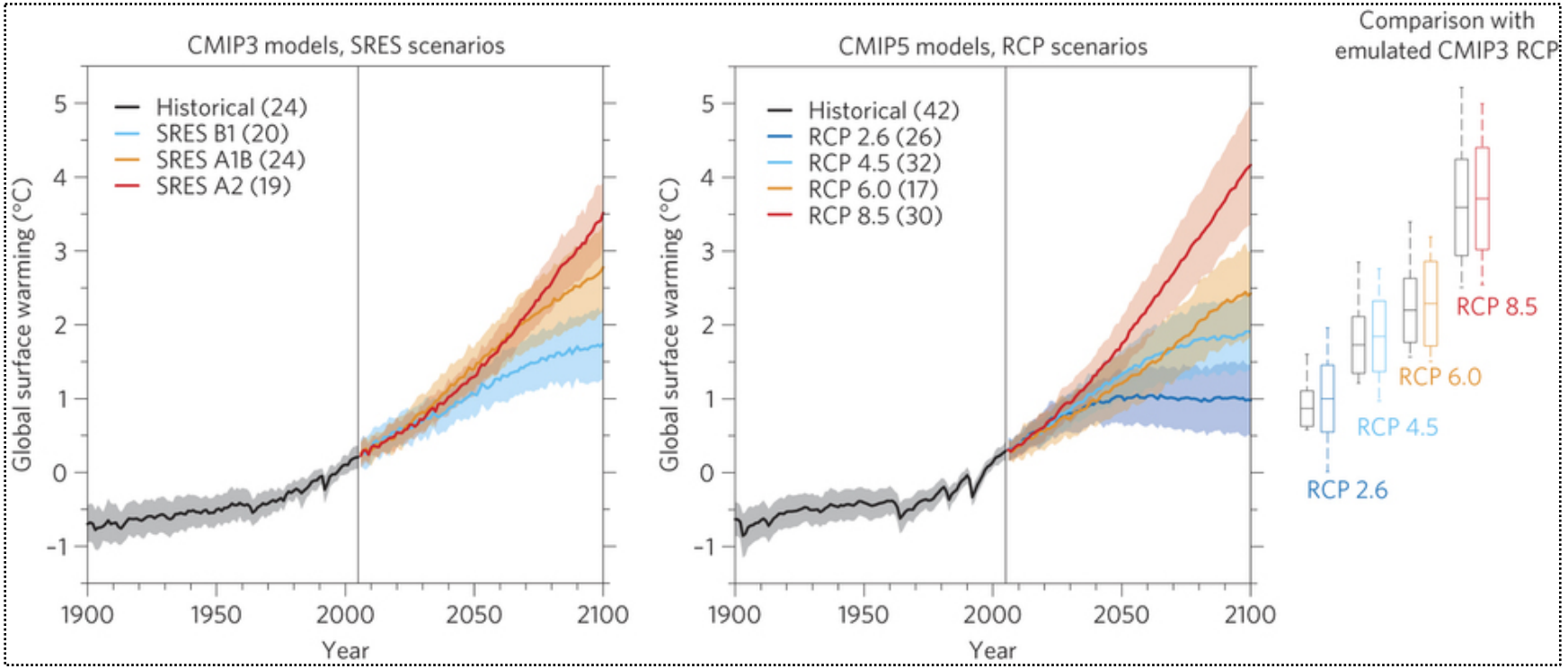
Uncertainty in projections



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Uncertainty in projections

CMIP6: Participating Model Groups

	Institution	Country		Institution	Country		Institution	Country
1	AWI	Germany	12	DOE	USA	23	MRI	Japan
2	BCC	China	13	EC-Earth-Cons	Europe	24	NASA-GISS	USA
3	BNU	China	14	FGOALS	China	25	NCAR	USA
4	CAMS	China	15	FIO-RONM	China	26	NCC	Norway
5	CasESM	China	16	INM	Russia	27	NERC	UK
6	CCCma	Canada	17	INPE	Brazil	28	NIMS-KMA	Republic of Korea
7	CCCR-IITM	India	18	IPSL	France	29	NOAA-GFDL	USA
8	CMCC	Italy	19	MESSY-Cons	Germany	30	NUIST	China
9	CNRM	France	20	MIROC	Japan	31	TaiESM	Taiwan, China
10	CSIR-CSIRO	South Africa	21	MOHC	UK	32	THU	China
11	CSIRO-BOM	Australia	22	MPI-M	Germany	33	Seoul Nat.Uni	Republic of Korea

New in CMIP:

2 new model groups from Germany (AWI, MESSY-Consortium)
4 new model groups from China (CAMS, CasESM, NUIST, THU)
1 new model group from Brazil (INPE)
1 new model group from India (CCCR-IITM)
1 new model group from Taiwan, China (TaiESM)
1 new model group from USA (DOE)
2 new model group from Republic of Korea (NIMS-KMA, SAM0-UNICON)
1 new model group from South Africa / Australia (CSIR-CSIRO)
==========
⇒ **13 new model groups so far**

More models (>70)
New models
More complex models
Higher resolution models

* Other models can join providing DECK and historical simulations are submitted

CMIP

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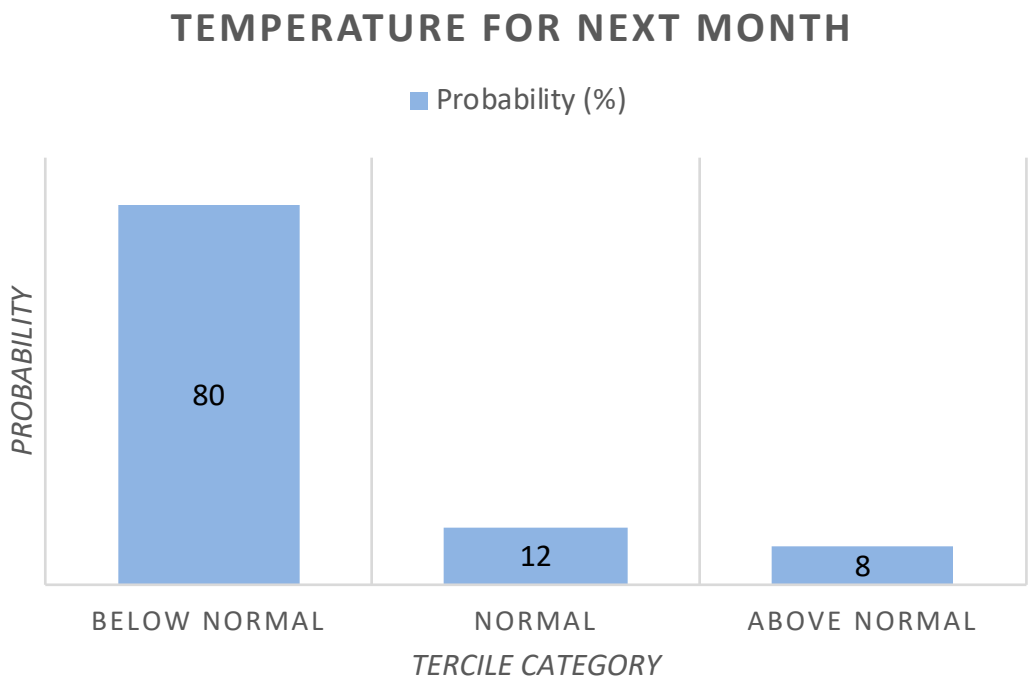
How to interpret probabilistic predictions

- **What would you say? Is this enough?**



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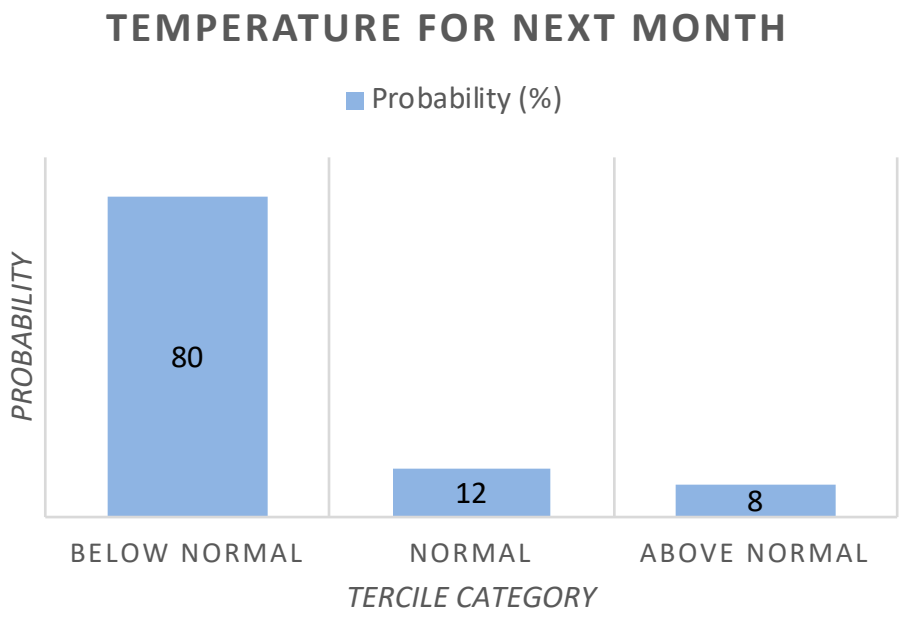
How to interpret the seasonal predictions

- **For decision making is important to take into account not only the probabilities but also the skill of the predictions.**



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How to interpret the seasonal predictions

- For decision making is important to take into account not only the probabilities but also the skill of the predictions.

RPSS < 0
RPSS = 0

Better to use the observed mean temperature of the past years as a prediction for the future.

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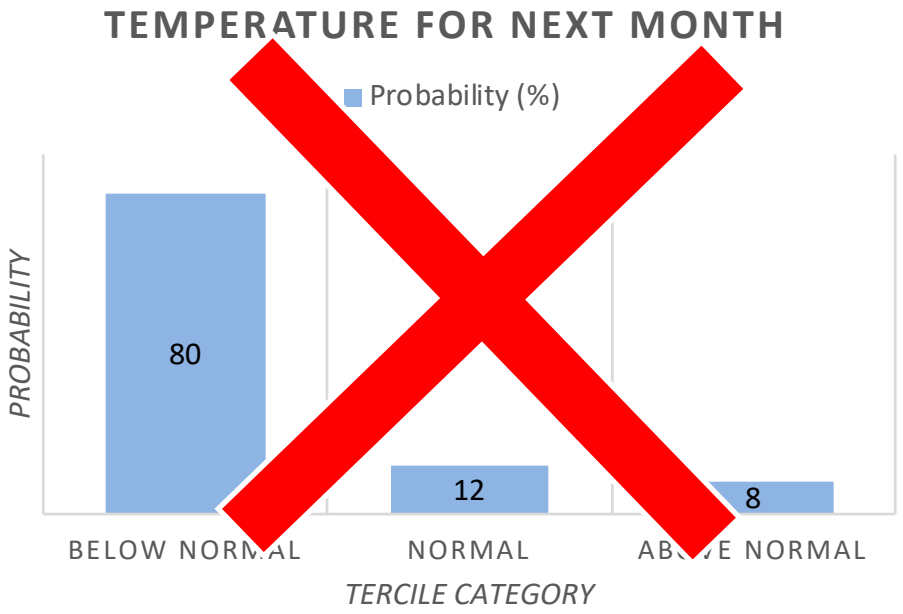
How to interpret the seasonal predictions

- For decision making is important to take into account not only the probabilities but also the skill of the predictions.

RPSS < 0

RPSS = 0



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How to interpret the seasonal predictions

- For decision making is important to take into account not only the probabilities but also the skill of the predictions.

RPSS > 0 → There is an added value of using this seasonal prediction over the use of mean past observations in the long term.

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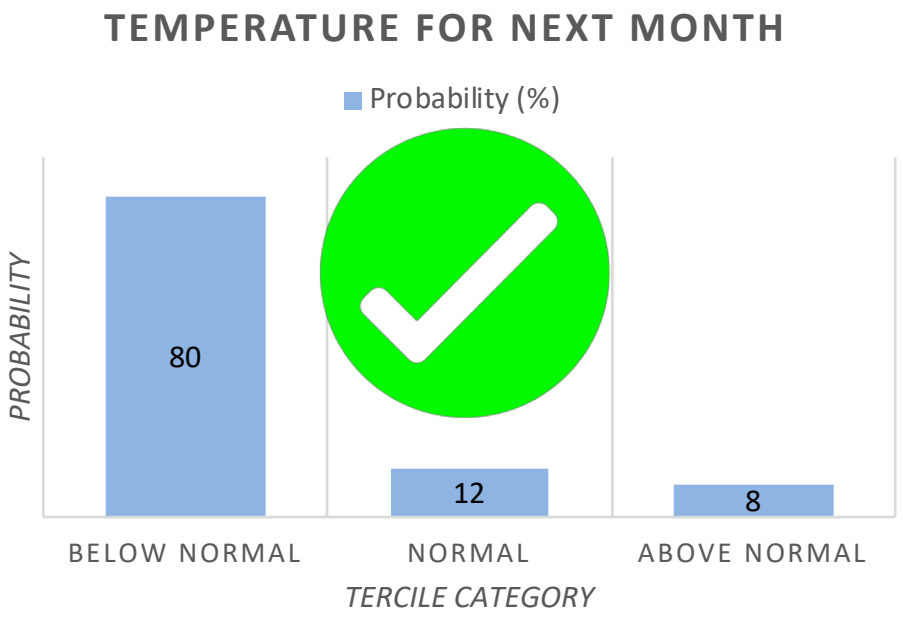
How to interpret the seasonal predictions

- For decision making is important to take into account not only the probabilities but also the skill of the predictions.

RPSS > 0



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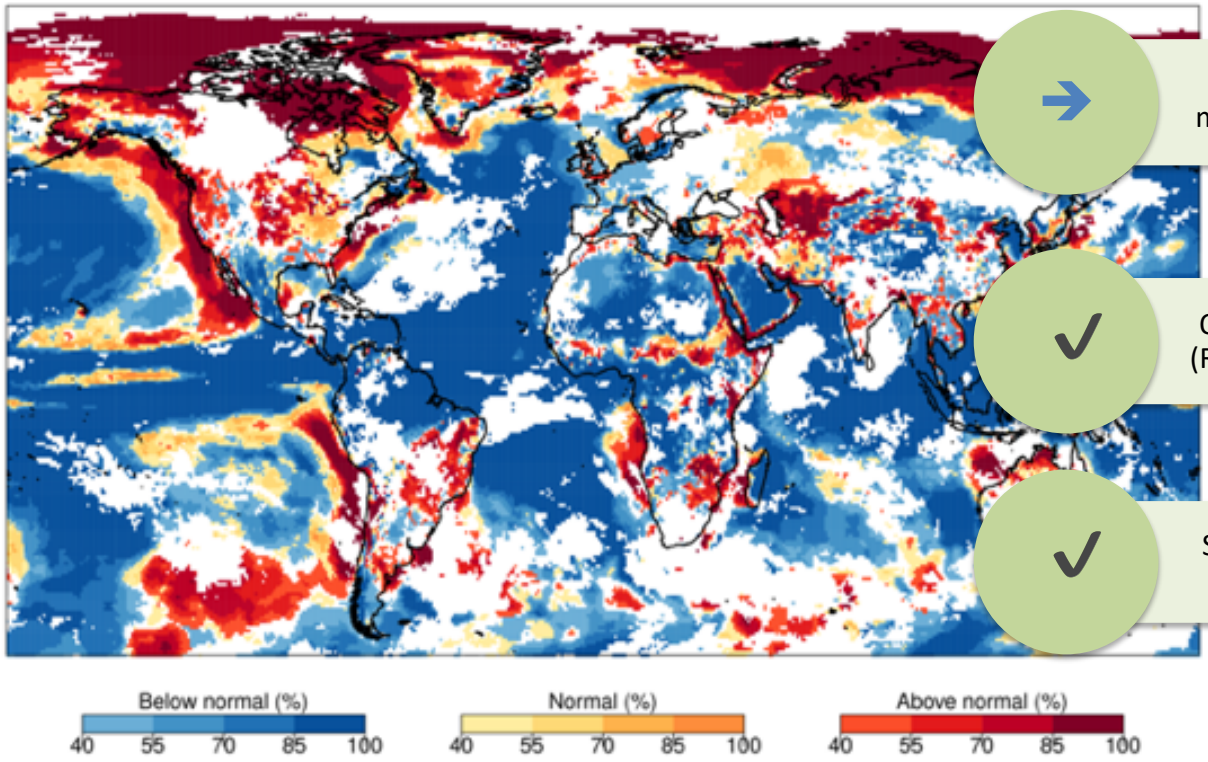
Climate service product: most likely category map

Seasonal prediction of most probable category of temperature for May 2016 with ECMWF S4



- How will be the next month/season temperature?
- ✓ Only areas with positive skill (RPSS) are shown to the users
- ✓ Summarising information in one map only

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Skill vs. Value

- It is important to note the **difference** between the **quality** of the forecast and its **value**.
  - A forecast is of **high quality** if it predicts well the conditions observed according to some objective criterion.
  - It has **value** if it helps the user to obtain some kind of benefit from the decisions he has to make.

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Skill vs. Value

A successful forecast of drought in the Sahara during the 'dry' season, does it have **quality**? And **value**?

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Protocol

- Ask ourselves about which aspect of the **quality / value** of our model we are interested in.
- Select the **verification metrics** and that allow us to adequately represent the attributes of interest.
- Choose a **comparison standard** that provides a reference level (persistence, climatology or old model).

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USERS NEED

Wind industry currently uses **climatology** for resource assessments

CLIMATE SERVICE

Semi-operational prototype that provides wind speed seasonal predictions

http://project-ukko.net

EUPORIAS

How do we engage wind industry users to consider using seasonal predictions besides climatology?

Demonstrating the **VALUE** of probabilistic predictions in economic terms

METHODOLOGY

We use the **Weather roulette** framework to show how climate predictions outperform the climatology in skillful areas

LET'S PLAY!

It has been designed as a game that you can play in the interactive screen

Weather Roulette framework is based on Hagedorn & Smith 2009.

Decision makers are not necessarily familiar with statistical techniques used for the calculation of skill scores in climate predictions, whereas economic and financial knowledge is widespread in the corporate world.

Weather roulette translates skill scores into commonplace concepts as interest ratios or return of investment.

METEOROLOGICAL APPLICATIONS
Meteorol. Appl. **16**: 143–155 (2009)
Published online 23 October 2008 in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/met.92

RMetS Royal Meteorological Society

Communicating the value of probabilistic forecasts with weather roulette

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[b] *Centre for the Analysis of Time Series (CATS), London School of Economics and Political Science, Houghton Street, London WC2A 2AE, UK*

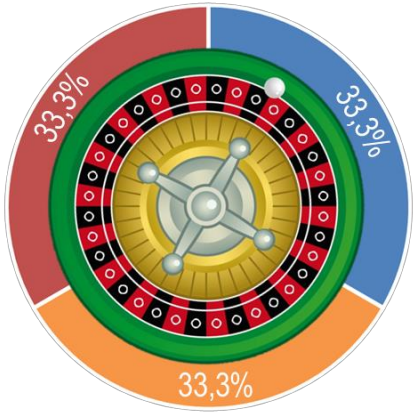
ABSTRACT: In times of ever increasing financial constraints on public weather services it is of growing importance to communicate the value of their forecasts and products. While many diagnostic tools exist to evaluate forecast systems, intuitive diagnostics for communicating the skill of probabilistic forecasts are few. When the goal is communication with a non-expert audience it can be helpful to compare performance in more everyday terms than 'bits of information'. Ideally, of course, the method of presentation will be directly related to specific skill scores with known strengths and weaknesses. This paper introduces Weather Roulette, a conceptual framework for evaluating probabilistic predictions where skill is quantified using an *effective daily interest rate*; it is straightforward to deploy, comes with a simple storyline and importantly is comprehensible and plausible for a non-expert audience. Two variants of Weather Roulette are presented, one of which directly reflects proper local skill scores. Weather Roulette contrasts the performance of two forecasting systems, one of which may be climatology. Several examples of its application to ECMWF forecasts are discussed illustrating this new tool as useful addition to the suite of available probabilistic scoring metrics. Copyright © 2008 Royal Meteorological Society

KEY WORDS diagnostic; forecast evaluation; value; score; communication; probability forecast; proper
Received 20 September 2007; Revised 17 May 2008; Accepted 24 June 2008

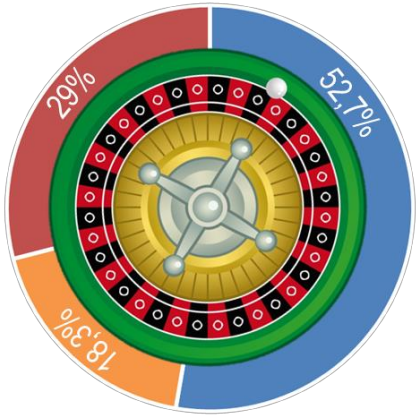
Next

To assess the value of probabilistic prediction for wind energy users, seasonal wind speed predictions **play against climatology**.

Climatology assumes a **fixed probability** to each category while climate predictions adjust the category probabilities of the 'climatology' forecast.



Climatology



RESILIENCE seasonal predictions

Expected wind speed:

- Above average
- Average
- Below average

In the game, the user bets proportionally to the probabilities estimated in the seasonal forecast (e.g. 52% of 10€ to below average winds = 5.2€ invested in the category)

The amount invested in the observed category is multiplied by 3 (i.e. the inverse of the climatology probability)

If the observed category had a larger probability in the forecast than in climatology, then the user earns money (e.g. 5.2€ x 3= 15.6€). Otherwise, the user looses money.

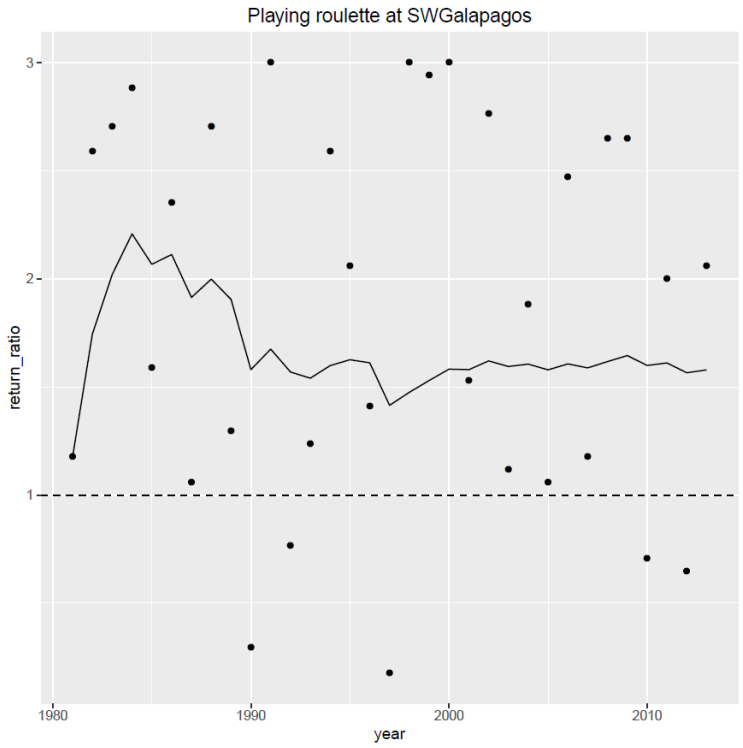
Next

- Initial investment of 10€
- Everything earned is reinverted

- 33 runs (from 1981 to 2013)
- Always in Winter period (Dec-Jan-Feb)

- In each game the skill of the seasonal predictions is provided as RPSS (Ranked Probability Skill Score)

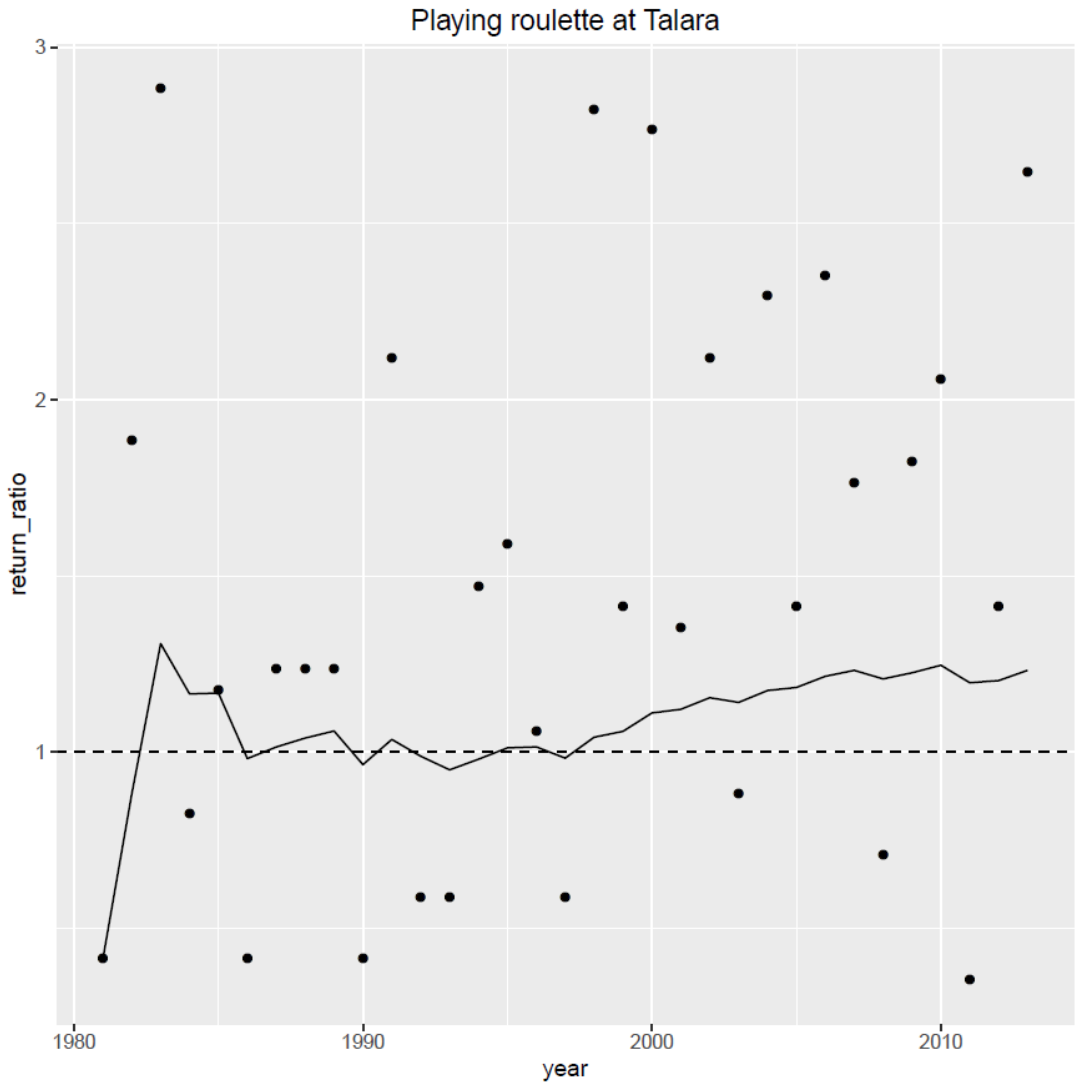
- The dots are the performance of the forecast in each run (individual return ratios)



- After a sufficient number of runs we calculate the geometric average of return ratios (the line)
- That can be indicated as interest rate too

Next

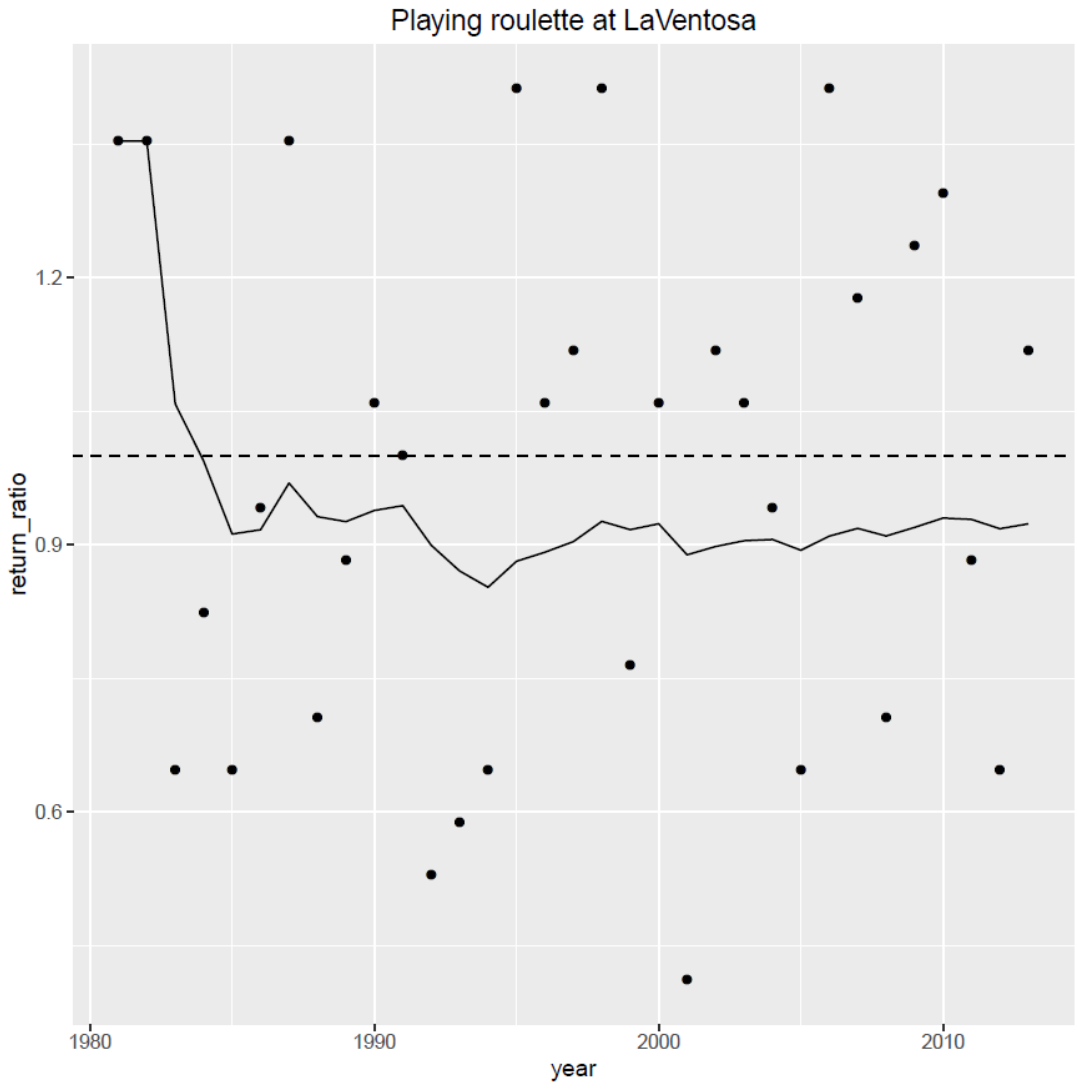
Back to the map
See all results in a table



Skill score (RPSS) = 0.29

Return ratio = 1.232
Interest rate = 23.2%

From 10€ inverted,
9 657€ returned after 33 runs



Skill score (RPSS) = -0.09

Return ratio = 0.924
Interest rate = -7.6%

From 10€ inverted,
70 cents returned after 33 runs

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SMART CLIMATE APPLICATION

Thank you for you Attention!

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www.visca.eu

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